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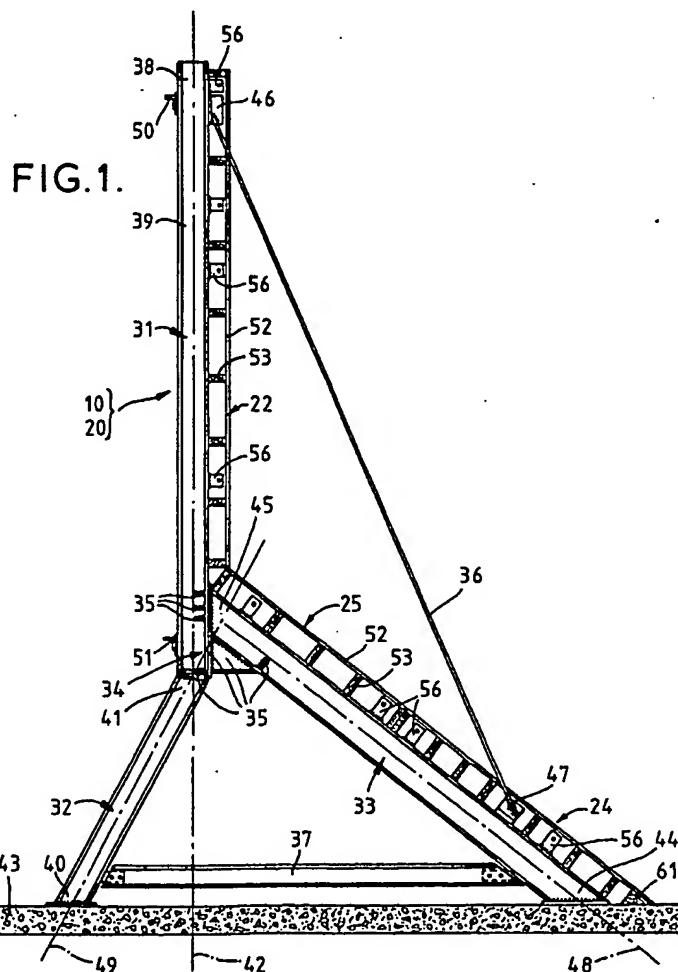
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(54) Grain barrier

(57) A silo comprises a series of adjacent grain barriers, each barrier comprising support units 20 wall panel units 22 and ramp panel units 24, 25. Each unit 20 comprises a buttress 32 and a ramp support member 33, inclined to meet at a junction 34, and an upright 31 upstanding from the junction. The units 22 and 24, 25 are respectively supported by the uprights 31 and members 33 to meet at an obtuse angle to give a self clearing ramp sloping up to a wall set back over the top of the buttress for maximum storage capacity. The ramp and wall are linked by ties 36.



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FIG. 3.

FIG. 1.

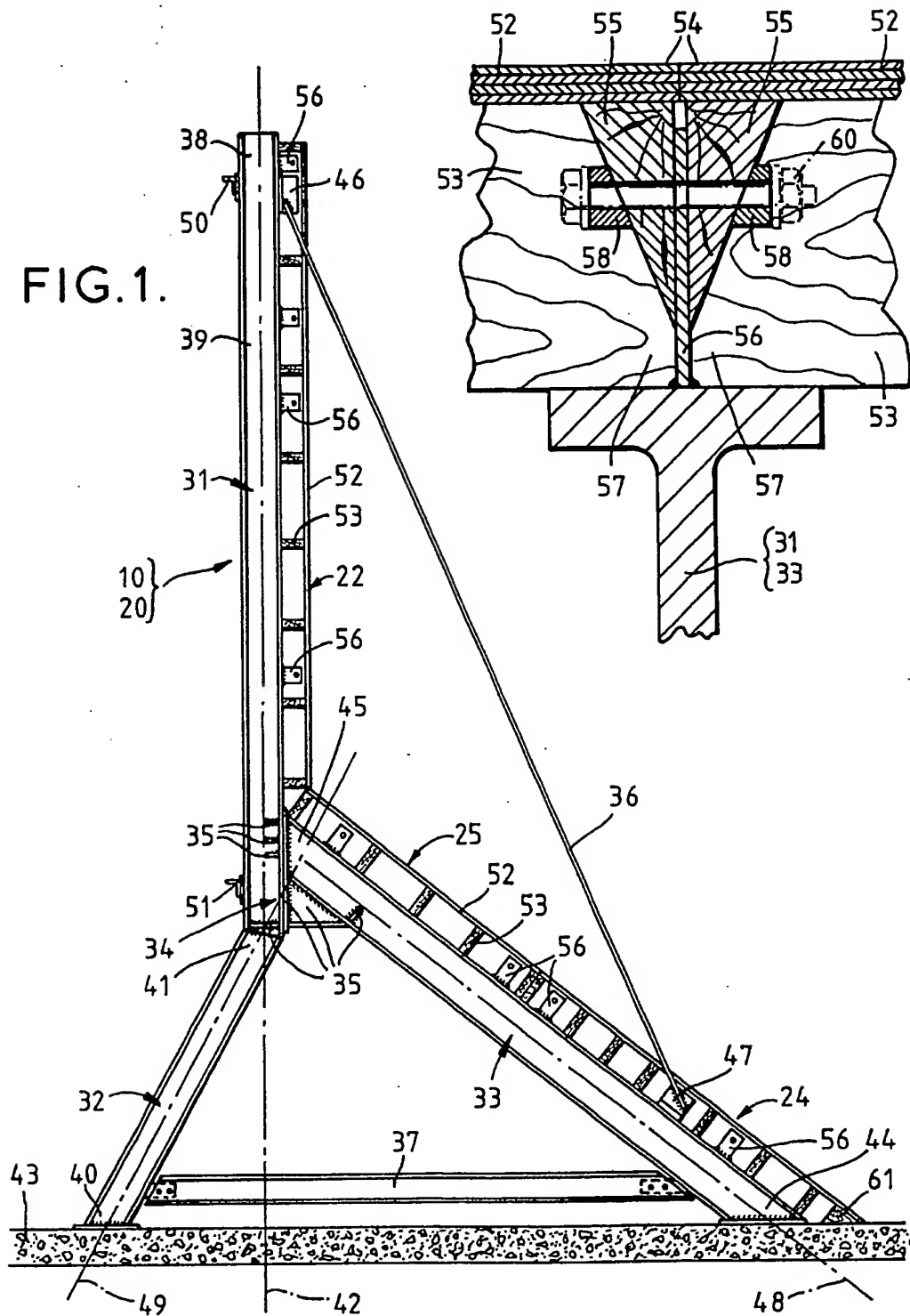
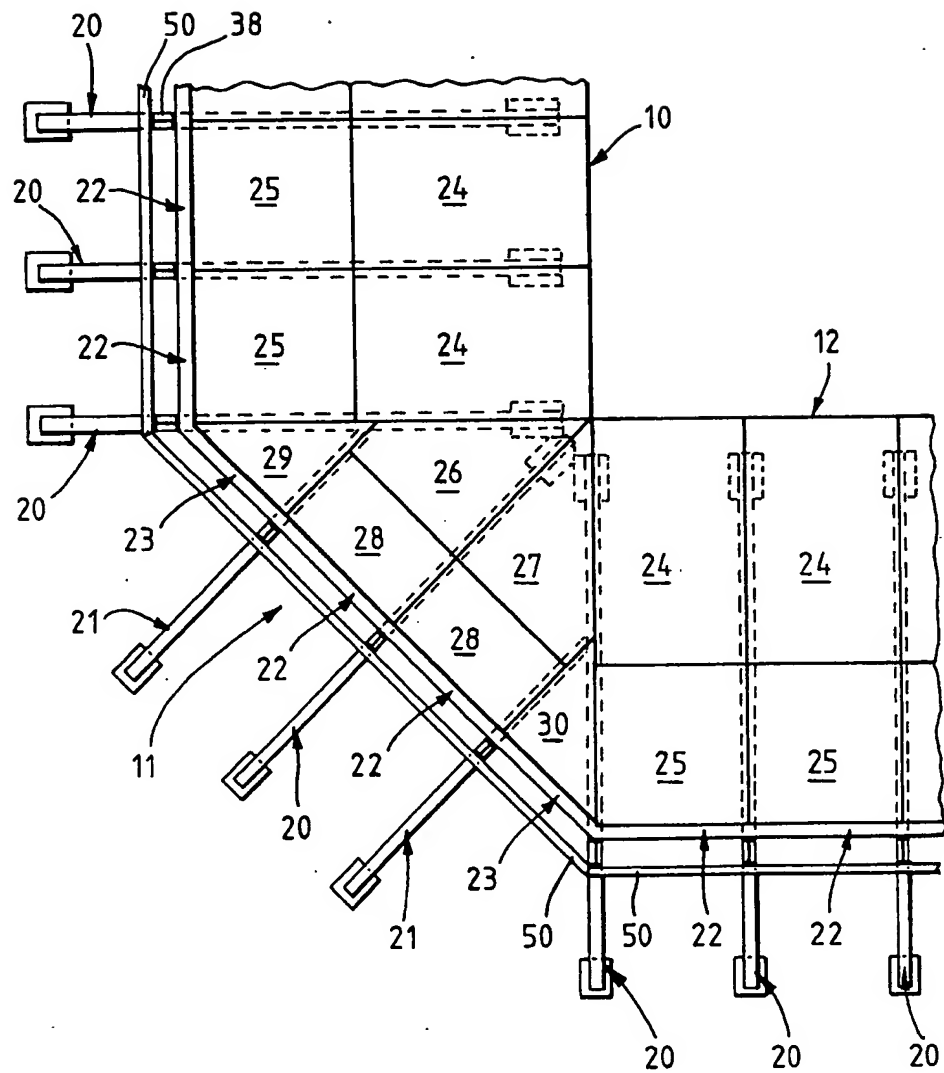


FIG. 2.



SPECIFICATION

Grain barrier or grain retaining devices

- 5 This invention concerns grain barrier or grain retaining devices used for forming a silo structure for storing granular, pulverised and other materials, for example grain.

- 10 Silo structures are known which comprise a peripheral barrier comprising a plurality of prefabricated upright wall panel units and upright support members to which the wall panel units are secured. In use, the grain stored in the silo exerts outwardly directed thrusts on the support members, via the wall panel units.

- 15 In small silos having a lower overall height, e.g. about 2 metres, the thrust is relatively small and the support members may be in the form of posts set-in in the ground or anchored to the floor of silo which posts have sufficient strength to resist the forces resulting from said thrust. However, in larger silos, e.g. having a height of three to four metres, the thrust is much larger, and the support members usually comprise posts and means for bracing the posts to withstand the forces arising from the thrust.

- 20 In a known form of silo, the means for bracing the posts comprises braces which are secured to and extend from the upper ends of the posts to anchorages provided within the silo. Such braces are subjected to tensile loads by said forces, and thus the anchorages have to be disposed at least two to three metres into the silo from the bottom of the posts. The provision of internal braces within the silo enables the cost and weight of the posts to be reduced, but has the disadvantage that the braces and their anchorages obstruct the use of, and can be damaged by, machinery for handling the grain.

- 25 Another form of silo, for storing silage, is shown in our British Patent Specification No. 1494873, and in this silo the wall panel units are supported externally by support units incorporating upright members and buttress members for bracing the upright members.

- 30 This form of silo has many advantages and the interior of the silo is left clear of obstructions, but has the disadvantage that, for a given height and storage capacity, the overall dimensions of the silo are considerably greater than those of a silo of post and brace construction.

- 35 The aforementioned silo structures of peripheral barrier form have the advantages that the structures can be easily erected, can be installed in an existing building, and are relatively inexpensive when compared with other forms of silo; and are often employed for bulk grain storage, especially temporary or emergency storage, even though the relatively restricted wall height of such structures necessarily restricts the storage capacity for a given

floor area.

An object of the invention is to enable the aforementioned disadvantages to be reduced.

- 40 According to the present invention there is provided a grain barrier or grain retaining device, for use in forming a silo, comprising at least one wall panel unit and a plurality of support units; wherein each support unit comprises an upright member, a buttress member having an upper portion rigidly connected to the upright member at a junction, and a further member rigidly connected to said upright member; and wherein said wall panel unit is secured to and extends between said upright members; and characterised in that:

- 45 (a) each upright member has a panel support portion which extends above said junction, the wall panel being supported by said panel support portion;

- 50 (b) each said further member is a ramp support member, an upper end portion of which is connected rigidly to said upright member at or adjacent to said junction;

- 55 (c) each ramp support member slopes downwards from said junction in a direction away from the buttress member of the support unit; and

- 60 (d) the ramp support members serve to support at least one ramp panel unit so that the latter extends downwards at an obtuse angle from or from adjacent to a bottom part of said wall panel unit.

- 65 In use, when lower end portions of the buttress and ramp support members are anchored to a floor, the barrier or device is stable and is resistant to said thrust. Forces resulting from said thrust on the ramp panel serve to further stabilise the barrier or device. The disadvantage concerning outward projection of the buttress members is minimised in the barrier or device of the invention, which also permits braces to be provided whilst minimising the aforementioned disadvantages thereof. Such braces are preferably in the form of elongate ties anchored to and extending from upper end portions of the upright members to anchorages adjacent to but offset from the lower end portions of the ramp support portions. The ramp panel, being inclined, causes the grain to slide or roll down to floor level handling machinery can be kept clear of the braces.

- 70 The buttress members are preferably in the form of struts; the upright members preferably terminate at said junctions so that a major proportion of the weight of the barrier or device is supported by the struts; and the lower end portions of the struts and the ramp members are preferably connected by further braces, so that access space is left below said junctions and above said further struts. The support units may be constructed primarily from metal so as to minimise the bulk of the support units, whilst the panel units are preferably of timber and plywood construction.

The ramp panel unit preferably has a gradient of 20° to 60° with an optimum of about 40°.

The maximum projection of the buttress member from the centre link of the upright member is preferably less than half, e.g. about one third, of the maximum projection of the ramp support member; and the overall height of the support unit is preferably at least twice, e.g. about three to four times, the height of said junction.

The invention will be described further, by way of example, with reference to the accompanying diagrammatic drawings, wherein:

FIGURE 1 shows, in side elevation, a support unit of a grain barrier or grain retaining device of the invention, together with parts of a wall panel unit and ramp panel units;

FIGURE 2 is a partial plan view of a silo constructed from a number of the grain barriers or grain retaining devices, with some parts omitted; and

FIGURE 3, is an enlarged cross section showing means for locating said panel units on the support unit.

The portion of the silo shown in FIGURE 2 comprises a longitudinal grain barrier or retaining device 10, a transverse grain barrier or retaining device 11, of similar prefabricated construction, and a corner grain barrier or retaining device 12, of a modified prefabricated construction. The devices 10, 11 and 12 comprise several support units 20, 21, together with wall panels 22, 23, and ramp panels 24, 25, 26, 27, 28, 29 and 30 arranged to form panel units.

Referring to FIGURE 1, each support unit 20 is about six metres high and comprises an upright member 31, a buttress member 32 and a ramp support member 33 all of H-section steel, which members are joined together at a junction 34 reinforced with welded-in stiffeners 35. A brace 36 connects the members 31 and 33, and a further brace 37 connects the members 32 and 33.

The upright member 31 has a short lower end portion which forms part of the junction 34, and the remainder of the upright member up to the upper end portion 38 serves as a panel support portion 39 of about four metres in height. The buttress member 32 is in the form of a strut about two metres long and extends from a bottom end portion 40 at a gradient of about 28° to an upper end portion 41 disposed at an angle of about 152° to the upright member 31, so that the maximum projection of the bottom end portion 40 from the longitudinal centre line 42 of the upright member 31 is about one metre at the level of the floor 43. The ramp support member 33 is almost as long as the panel support portion 39 and extends from a bottom end portion 44 at a gradient of about 38° to an upper end portion 45 disposed at an angle of about 142° to the upright member 31, so that the

maximum projection of the bottom end portion 44 from said line is about three metres at floor level. The brace 36 is in the form of a tie rod secured to a top anchorage 46 provided adjacent the end portion 38 and a lower anchorage 47 provided on the member 33 about one metre from the end portion 44.

The junction 34 is arranged so that the longitudinal centre link 48 of the member 33 intersects said centre line 42 at a point about half a metre above the point at which said line 42 is intersected by the longitudinal centre link 49 of the member 32, so that the line 49 extends through the upper end portion 45.

The support units 20A and 21 are similar to the support units 20 except in that the braces 36 and 37 are modified and in that in the units 21 the ramp support members are shortened to omit the bottom end portion 44 and are modified for securing to the ramp support members 33 of adjacent ones of the support units 20.

Cross members 50 extend horizontally between and are secured to the upper end portions 38, and similar cross members 51 connect the junctions 34 to connect the support units. The bottom end portions 40, 44 are anchored, e.g. by foundation bolts, to the floor 43.

The panels 22 to 30 each comprise a plywood facing 52 secured to timber cross bearers 53, and end pieces 55 (shown only in FIGURE 3). The cross bearers 53 span between adjacent support units 20, 21 and rest thereon as shown in FIGURE 3, which Figure also shows means for securing the panels to the support members 31 and 33. The ends 57 of the cross bearers 53 are cut obliquely below the margins 54 of the facing 52 to accept the tapered end pieces 55 which are secured to said margins 54. Each support member 31, 33 is provided with welded-on lugs 56, and the panels are dimensioned so that said lugs can be clamped between adjacent end pieces 55 of abutting panels when the ends 57 rest on the support members. Tapered washers 58 are provided and the lugs 56 and end pieces 55 are apertured to accept threaded fasteners 60. Each of the panels 24 is provided with a tapered lower cross bearer 61 which rests on the floor.

The wall panels 22 and 23 each constitute single panel units; whereas the panels 24 and 25, and the panels 27 and 28, constitute two panel units which abut and slope downwards at about 142° from the wall panel units. The panels 29 and 30 form single panel units bridging between ramp panels of adjacent ramp panel units at the corners of the grain barrier or retaining device 10.

The grain barrier or retaining device 10 has the further advantages that it is easy to erect, to dismantle and to re-erect in a different configuration; that it is relatively inexpensive for a given storage height; that it offers in-

creased storage height compared with known devices of the kind disclosed in Patent Specification No. 1494873; that grain can be heaped to several metres above wall height; and that access is provided below the junction, e.g. for inspection of the underside of the ramp panels. The barrier or retaining device is particularly suitable for constructing a bulk grain silo within a barn or other building to utilise the most of capacity of the building with minimal wastage of space between the respective support units may be selected to accommodate, between such support units, columns or other internally projecting structural members of the building.

The invention is not confined to the precise details of the foregoing example, and many variations and modifications are possible within the scope of the invention.

CLAIMS

1. A grain barrier or grain retaining device, for use in forming a silo, comprising at least one wall panel unit and a plurality of support units; wherein each support unit comprises an upright member, a buttress member having an upper portion rigidly connected to the upright member at a junction, and a further member rigidly connected to said upright member; and wherein said wall panel unit is secured to and extends between said upright members; and characterised in that:

(a) each upright member has a panel support portion which extends above said junction, the wall panel being supported by said panel support portion;

(b) each said further member is a ramp support member, an upper end portion of which is connected rigidly to said upright member at or adjacent to said junction;

(c) each ramp support member slopes downward from said junction in a direction away from the buttress member of the support unit; and

(d) the ramp support members serve to support at least one ramp panel unit so that the latter extends downwards at an obtuse angle from or from adjacent to a bottom part of said wall panel unit.

2. A grain barrier or grain retaining device as claimed in claim 1 further comprising braces in the form of elongate ties anchored to and extending from upper end portions of the upright members to anchorages adjacent to but offset from the lower end portions of the ramp support portions

3. A grain barrier or grain retaining device as claimed in claims 1 or 2 wherein the buttress members are in the form of struts and the upright members terminate at said junctions so that a major proportion of the weight of the barrier or device is supported by the struts.

4. A grain barrier or grain retaining device as claimed in claim 3 wherein the lower end

portions of the struts and the ramp members are connected by further braces, so that access space is left below said junctions and above said further struts. The support units may be constructed primarily from metal so as to minimise the bulk of the support units, whilst the panel units are preferably of timber and plywood construction.

5. A grain barrier or grain retaining device as claimed in claims 1, 2, 3 or 4 wherein the ramp panel unit has a gradient of 20° to 60°.

6. A grain barrier or grain retaining device as claimed in claim 5 wherein said gradient is about 40°.

7. A grain barrier or grain retaining device as claimed in any preceding claim wherein the maximum projection of the buttress member from the longitudinal centre line of the upright member is less than half of the maximum projection of the ramp support member; and wherein the overall height of the support unit is at least twice the height of said junction.

8. A grain barrier or grain retaining device as claimed in claim 7 wherein said projection of the buttress member is about one third of the projection of the ramp support member.

9. A grain barrier or grain retaining device as claimed in claims 7 or 8 wherein the height of the support unit is three to four times the height of the junction.

10. A grain barrier or grain retaining device as claimed in any preceding claim wherein each support unit is constructed from metal, wherein said junction is provided with stiffeners, and wherein said junctions are connected by a horizontal cross member.

11. A grain barrier or grain retaining device substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

12. A grain barrier or grain retaining device as claimed in any preceding claim and comprising several of the wall panel and ramp panel units arranged so that adjacent end portions of adjacent panels are secured together and to lugs on the support units substantially as hereinbefore described with reference to Figure 3 of the accompanying drawings.

13. A silo comprising grain barriers or retaining devices as claimed in any preceding claim, wherein the silo includes a corner barrier or device arranged substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

14. A grain barrier, retaining device or silo substantially as hereinbefore described with reference to and as shown in the accompanying drawings.